Do Islamic banks lead or lag conventional banks? Evidence from Malaysia

Amirudin Mohd Nor and Mansur Masih

INCEIF, Malaysia, INCEIF, Malaysia

11 May 2017

Do Islamic banks lead or lag conventional banks? Evidence from Malaysia

Amirudin Mohd Nor[1] and Mansur Masih[2]

This paper explores the causal relationship between Islamic banks' non-performing financing (NPF) and conventional banks' non-performing loans (NPL) for the banking industry in Malaysia. To further understand these asset quality variables, we added domestic macroeconomic variables namely domestic credit, real lending rate and exchange rate for the period January 2007 to January 2017. Using time series cointegrating VAR models, coupled with the Long Run Structural Modelling (LRSM), Vector Error Correction Model (VECM) and Variance Decompositions (VDC), the results tend to suggest that NPF leads NPL. Contrary to expectation, the VDC results suggest that NPF and NPL variables are leading and lagging respectively. This unexpected result gives rise to many interesting arguments especially within the Islamic banking perspectives. Apart from providing important insights into the causality between NPF and NPL, our results contribute to the policy implications. Interest rate variable being the most leading variable may be used to affect both NPFs and NPLs.

Keywords: non-performing financing, non-performing loans, causality, LRSM

[1]Graduate student in Islamic finance at INCEIF, Lorong Universiti A, 59100 Kuala Lumpur, Malaysia.

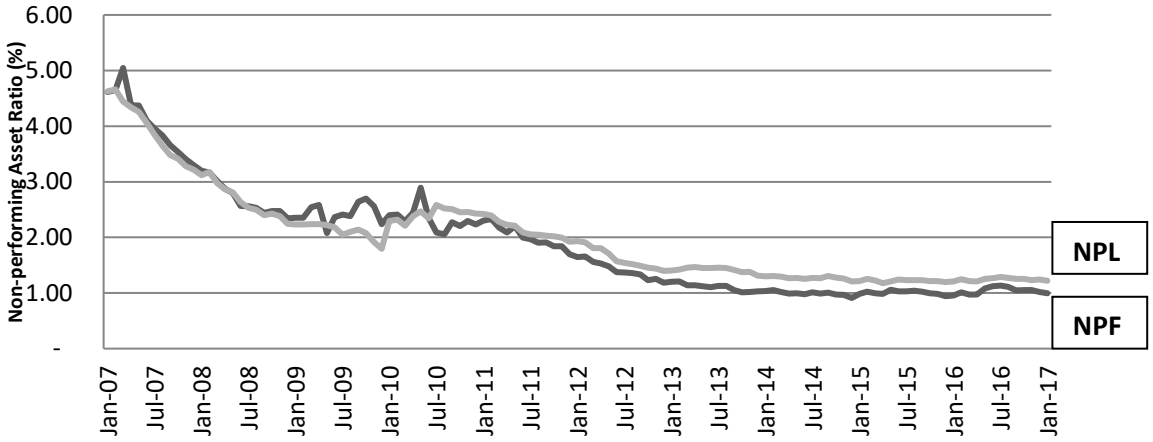
[2] **Corresponding author**, Professor of Finance and Econometrics, INCEIF, Lorong Universiti A, 59100 Kuala Lumpur, Malaysia. Phone: +60173841464 Email: mansurmasih@inceif.org

1. Introduction: The issue motivating the paper

Studies on determinants of asset quality (Islamic banks non-performing financing (NPF) and conventional banks non-performing loans (NPL)) using regression analysis are abundant (see Dimitrios, Helen, & Mike (2016), Chaibi & Ftiti (2015), Beck, Jakubik, & Piloiu (2015), Ghosh (2015), Abid, Ouertani, & Zouari-Ghorbel (2014), Louzis, Vouldis, & Metaxas (2012), while studies on causal relationship on asset quality are very limited (see Klein (2013) and Fofack (2005). Studies on causal relationship however are generally confined to the causal relationship between Islamic banks or conventional banks asset quality and the macroeconomic variables. Very few studies are done to look at the long term causal relationship between NPF and NPL.

Since long run causal relationship study incorporating both Islamic and conventional impaired assets on a direct basis is very limited, therefore it is worth an exploration. Are the Islamic and conventional banks asset quality connected in the long run? Between them which is leading and which is lagging (NPF leads NPL or vice versa)? The question has yet to be resolved.

Figure 1: Non-performing/ Impaired Assets (Malaysia: Jan 2007-Jan 2017): Islamic vs Conventional Banks (%)



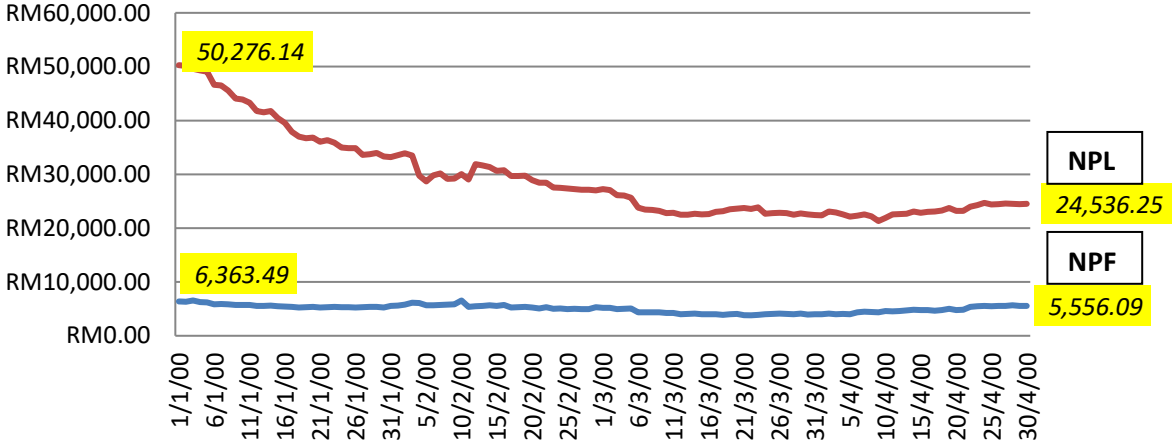
Source: Monthly Statistical Bulletin February 2017

Note: Beginning financial year 2010, banking institutions are required to report impaired financing in accordance with the Guideline on the Classification and Impairment Provisions for Financing/loans. The reporting of non-performing financing/loan has since been discontinued. In terms of NPFs classifications, the latest classification of financing as impaired is stated in the Bank Negara Malaysia guidelines on the Classification and Impairment Provisions for Loans/Financing 2015. A banking institution shall classify a loan/financing as impaired: (i) where the principal or interest/profit or both of the loan/financing is past due for more than 90 days or 3 months. In the case of revolving facilities, (e.g. overdraft facilities), the facility shall be classified as impaired where the outstanding amount has remained in excess of the approved limit for a period of more than 90 days or 3 months; or (ii) where the amount is past due or the outstanding amount has been in excess of the approved limit for 90 days or 3 months or less, the

loan/financing exhibits weaknesses in accordance with the banking institution's credit risk grading framework; or (iii) when the loan/financing is classified as rescheduled and restructured in CCRIS (Bank Negara Malaysia, 2015).

These possible relationships give some insights on the asset quality behaviour at present. Generally, in line with consensus, we anticipate that NPL (expected to be exogenous) will lead NPF (expected to be endogenous). This can be explained by the fact that in the banking system, NPF in terms of Ringgit Malaysia is small as compared to NPL (see graph 1 & 2) coupled with reasoning that Islamic and conventional banks operations is almost identical. Both offers similar banking products and therefore behaves similarly when it comes to asset quality. On the other hand, NPF can also lead NPL, however with lower probabilities. NPF derived its value from shariah compliant products which arises from Islamic principles different from the conventional products. Islamic product operates on the basis of no *riba*, *gharar,* forbid gambling and other non-ethical activities. This difference make shariah compliant product unique with niche market but yet sufficient to create large demand from time to time.

Figure 2: Non-performing/ Impaired Assets (Malaysia: Jan 2007-Jan 2017): Islamic vs Conventional Banks (RM Million)



Source: Monthly Statistical Bulletin February 2017

Note: Beginning financial year 2010, banking institutions are required to report impaired financing in accordance with the Guideline on the Classification and Impairment Provisions for Financing/loans. The reporting of non-performing financing/loan has since been discontinued.

The answers to these questions are very important to the policy maker such as Bank Negara Malaysia (BNM) who among its objectives is to ensure a healthy banking system in Malaysia, trying its level best to link both Islamic and conventional harmoniously while working hand in hand. Should a financial crisis emerge again, should BNM formulate a solution on aggregate basis or separate basis between the two banking sectors? What are the other exogenous variables that BNM can tackle to influence Malaysia's asset quality? A balance attention for both banking sector is much preferred as their

stakeholders comes from the aggregate banking sectors. To the practitioners, the Islamic or conventional banks, this research helps the management of its banking portfolio especially in the times of crisis. Our study tries to provide these answers based on an empirical study.

2. Literature Review

The body of literature on asset quality can be broken down into two groups: (1) the study on the determinants of asset quality, and (2) causal relationship between asset quality and macroeconomic variables. The first group of the relevant studies consists of the study on determinants of asset quality. Florin (2015) applied the ordinary least square regression on Romania and EU for 2001 to 2012 period and reveals highly significant positive correlation between real GDP and NPL. In a different region and in a much recent study, Beck et al. (2015) regressed NPF with macroeconomic studies to observe the determinants of non-performing loans. Beck et al. (2015) studies the role of economic in 75 countries for 2000 to 2010 dataset. Applying NPL to total gross loans, he discovers real GDP, nominal effective exchange rate, real lending rate and share price to significantly affect NPLs. Louzis et al. (2012) uses 2003 to 2009 data for nine Greek commercial banks to study the consumer, business and farm loans NPLs. He found a negative and positive relationship between NPLs and real GDP growth rate and real lending rates respectively. Louzis et al. (2012) also emphasis in line with the life cycle consumption model, default is lower at the expansionary phase owing to the good ability via steady income stream, to pay debt obligation. On the same note, Abid et al. (2014) and Chaibi & Ftiti (2015) found similar results on both variables for Tunisian and French/ German banks respectively. Abid et al. (2014) studied dynamic panel data method over 2003-2012 to observe the determinants of household's NPLs in Tunisian banks and concurs that macroeconomic variables explains NPLs. Nevertheless, the insignificant real interest rate reveals by Ghosh (2015) on his study on 50 commercial banks and savings institutions in 1984 to 2003 data contrasts the panel study of Louzis et al. (2012), Abid et al. (2014) and Chaibi & Ftiti, (2015). Using GMM estimation on 147 French and 133 German banks between 2005 to 2011, Chaibi & Ftiti (2015) also evidenced both the positive and negative relationship between exchange rate and NPLs.

The second group of studies focus causal relationship between asset quality and macroeconomic variables. Klein, (2013) examines the feedback effects between the banking systems and the economic

activities impact of macroeconomic performance for 10 largest banks in 16 central eastern and south eastern Europe (CESEE) and confirms the strong macroeconomics and financial linkages in the CESEE area. The study also indicates strong feedback effect from the banking system and the real economy, specifically the rise in bad asset quality has a significant impact on credit. Using Granger causality analysis and pseudo-panel models, Fofack (2005) discover that inflation, real interest rate, net interest margin, return on assets and interbank loans Granger cause asset quality in a number of countries in Africa.

The foregoing discussions reveal two potential gaps. First, notwithstanding the conventional bank, very few has considered Islamic banks assets quality as focus of study despite Islamic bank as one of the component in the banking institutions. Secondly, the long-run causality analysis between both Islamic and conventional asset quality as the focal variables in a group is rare. The results are particularly important to the policy maker as to formulate various policies to stabilize or combat bad asset quality.

In this paper we wish to add to the existing asset quality literature by answering the unresolved questions on are the Islamic and conventional banks asset quality connected in the long run? Between them which is leading and which is lagging (NPF leads NPL or vice versa)? In this empirical study, we applied the eight-step procedure for long term cointegration technique summarized by Masih (2017). Based on the aforesaid literature, we have decided to use non-performing assets and non-performing loans as the focal variable, the domestic credit, the real lending rate and the exchange rate as our macroeconomic controlling variables.

3. The Objective of the Study

In this study, we wish to investigate the issue as to whether there is any significant long-run causal relationship between impaired assets of Islamic bank versus the impaired assets of the conventional banks on a direct basis in a single platform. Understanding the behaviour of the two types of banking impaired asset is crucial to Malaysian stakeholders since both banks operate in a dual banking system. The Study will depart from earlier works in the following ways: (1) direct lead –lag comparison between asset quality of Islamic and conventional banks; (2) in addition to the Granger causality analysis done in the literature, we employ Long Run Structural Modelling (LRSM) by Pesaran & Shin (2002), Vector Error Correction Model (VECM) and Variance Decomposition (VD) to further produce better meaningful results; (3) we

provide answers to the policy maker such as Bank Negara Malaysia (BNM) and the practitioners of the Islamic or conventional banks in formulating policies and
managing banking portfolios respectively.

4. Theoretical Review

In this study of the causal relationship between NPF and NPL, we incorporated other macroeconomic variables based on the literature and the theories. The description of all the variables can be found in table 1 below.

Table 1: Description of variables

No	Variable	Description	Symbol	Source
1	Non Performing Financing (NPF)	NPF/ total financing	NPF	Bank Negara Malaysia
2	Non Performing Loan (NPL)	NPL/ total financing	NPL	Bank Negara Malaysia
3	Credit	Claim on the private sector	CRE	Datastream
4	Interest rate	Real ending rate	IR	Datastream
5	Exchange rate	RM to 1USD	EX	Datastream

The economic stages determine the probability of default and non performing loans. It is the fluctuation deriving from the macroeconomic environment that causes these defaults (Kavkler, Repina, & Festic, 2011). When the economy is in the expansion phase, businesses prosper resulted in individuals and firms having surplus cash flow. This in turn increases their ability to serve their debt obligation and hence translate into lower NPLs. As the economy starts to boom, so is the credit growth. Credit is extended to lower quality debtors and when the economy starts to reach its peak and recession take place, the NPL increases (Louzis et al., 2012). When economy expands, the level of credit risk is higher because risk is built up in a boom but materializes in downturn (Claudio Borio & Lowe, 2002). Hence, the link between the phase of the macroeconomic cycle and credit default exists.

Determinants of NPLs can be connected to theoretical model of business cycle and life-cycle consumption model. The life-cycle consumption model such as Lawrence 1995 states that the borrowers with low income have higher rates of default due to increased risk of facing unemployment and being unable to settle their obligations. Banks then charge higher interest rates to riskier customer. Default is then sparks by uncertainty of future income and the lending rates (Ghosh, 2015). In this connection, the amount of credit extended to banks clients will deteriorate.

The following are the expected outcome with regards to the selected variables: ***NPF and NPL:*** We expect NPL to leads NPF. This can be explained by the fact that in the banking system, NPF in terms of numbers is small as compared to NPL coupled within reasoning that Islamic and conventional banks operations is almost identical. Both offers similar banking products and therefore behaves similarly when it comes to asset quality. ***Credit***: Theoretically, credit to the private sector is expected to grow more rapidly in the periods preceding the crises. However, the lending boom in the pre-crisis period is generally followed by a fall in domestic credit in the outbreak of the crisis (Fofack, 2005). We expect a negative relationship between these variables. ***Interest rate***: Higher interest rates tend to increase NPLs as the cost of borrowings is higher and weakens ability to pay (Louzis et al., 2012). The effect of interest rate and NPF is assumed to be positive. ***Exchange rate***: Unexpected depreciation on domestic currency translates to higher costs to banks that borrow in foreign currency but lend in domestic currency (C Borio & Lowe, 2002). Higher exchange rate increases local prices, makes export less competitive and adversely affect repayment capability. In this instance, depreciation of local currency leads to a rise in NPLs. In other situation, appreciation of local currency improves the repayment service capacity for company that borrows in foreign currency (Chaibi & Ftiti, 2015). Therefore, we expect the relationship to be either positive or negative.

5. The Methodology Used

In this research we employ the time series techniques. As oppose to the standard classical regression technique employed in majority of the research on asset quality, the time series technique is somewhat different as it treated all variables equally without predetermined the independent and independent variables. After a few steps, the data will help us to determine the appropriate dependent as well as the independent variables. In this paper, we are considering the cointegrating VAR models.

The first step requires pre-testing for unit roots to ascertain the non-stationary/ stationary for each variables using the natural logarithm data where all variables are made stationary in the variance. Ideally, all variables should be I(1) where they are non-stationary at level form and stationary at 1st difference. This prerequisite requirement is for the purpose of performing the cointegration test in step 3 where long term variables is needed for the cointegration test. We next proceed to selecting the order of VAR. The cointegration test using the Engel and Granger cointegration test together with Johansen cointegration test was performed to confirm the existence of long term relationship between the variables. Existence of

cointegration in either tests rule out spurious relationship among the variables and prove the long term theoretical among the variables. The Granger causality test eas used to identify whether NPF leads NPL or vice versa. Then VECM was applied to indicate the direction of the Granger causality both in the short and long run and the VDC technique was applied to indicate the relative exogeneity/ endogeneity of the variables by decomposing the variance of the forecast error of a variable into propotions attributable to shocks in each variable in the system including its own (Masih and Masih, 2001). Impulse Response Function (IRF) was used to indicate the graphical exposure relative exogeneity and endogeneity of the variables. The Persistence Profiles (PP) are applied to estimate the speed with which the variables get back to equilibrium when there is a system wide shock.

6. Data, Empirical Results and Discussions

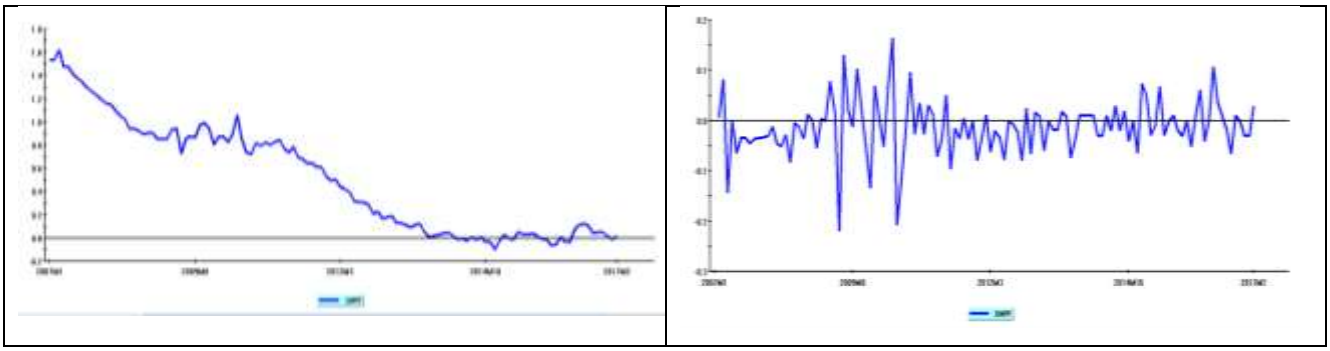
We extracted data from Bank Negara Malaysia monthly bulletin February 2017 series and Datastream. The data cover 121 samples of Malaysia monthly economic data for the period from January 2007 through January 2017. In the analyses that follow, we take the natural logarithm of each variable to make the variables stationary in the variance. The time series data is then ran using Microfit 5 software by considering the cointegrating VAR models summarized by Masih (2017) into an 8 steps procedure. This time series technique is unique in the sense that the data will assist us to determine the dependent and independent variables as oppose to the predetermined theoretical assumption in the classical regression model.

The focal variable is NPF and NPL in which we use the ratio of net Impaired financing to net total financing (%) and ratio of net Impaired loans to net total loans (%) respectively. Various control variables has been added as suggested in the literature. Domestic credit represented by claims by public sector (Klein, 2013), interest rate variable using the real lending rate (Louzis et al., 2012, Beck et al., 2015) and exchange rate using the Ringgit Malaysia to USD rate (Beck et al., 2015). Table 1 gives the sources of the data and shows the expected signs of the variables used.

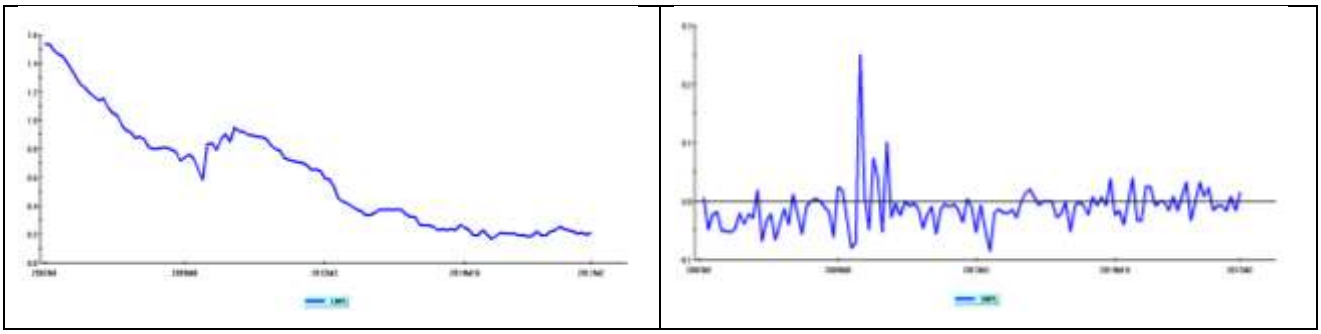
Below we present the results and findings for the 8 steps procedures:

STEP 1: UNIT ROOT TEST

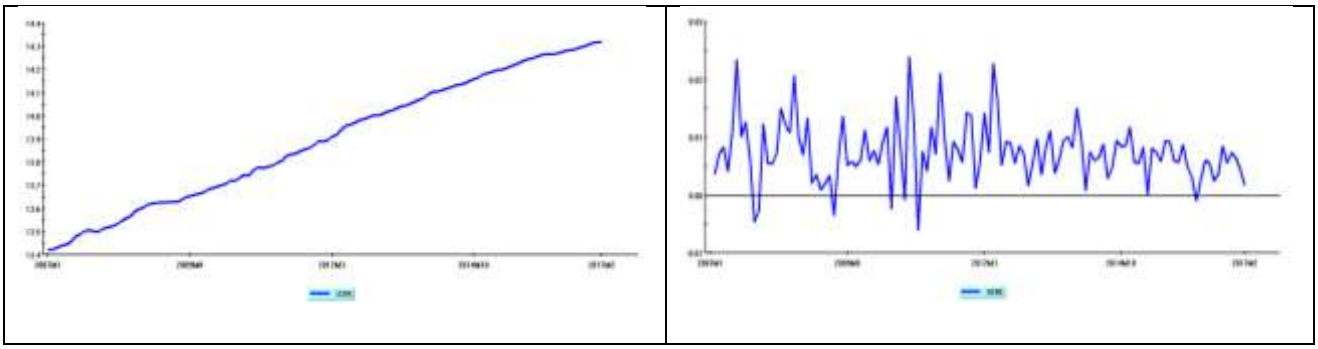
Unit root was performed to identify whether the variables are stationary at level or at first difference. This standard procedure is required in our case as we are performing a long term cointegration test in step 3. At this stage the precondition is the variables to be non-stationary at level. Non-stationary data in this step is required as it contains the long term information of the variables which suits well for the cointegration test which long term in nature. Non-stationary means the variable is 100% connected to on its own past which contains and retain long-term memories. Differencing the variables turned the variables stationary and this removes the long term information contained in the trend element resulted in short-run relationship between the variables and hence fail to test any theory (M. Masih, Al-sahlawi, & Mello, 2010). The cointegration test using Engle and Granger as well as Johansen takes care of the problems mentioned earlier.



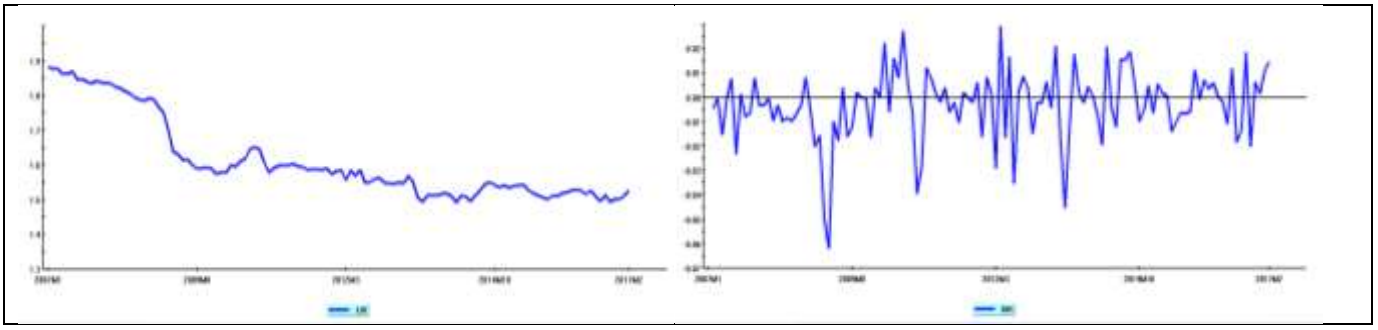
1) LNPF DNPF



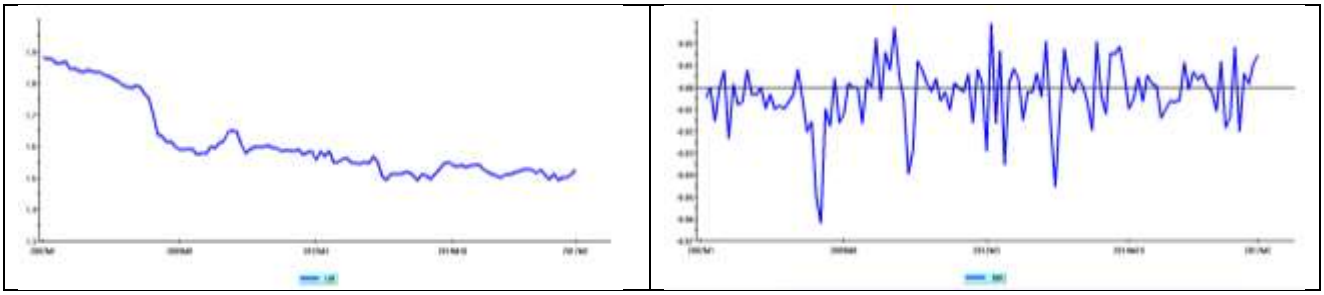
2) LNPL DNPL



3) LCRE DCRE



4) LIR DIR



5) LER DER

Table 2: ADF test for Unit root

H0: = 0 (Yt is a unit root/non-stationary)
H1: ≠ 0 (Yt is stationary)

Level						1ST Difference					
Variables		**T Stat**	**Sign**	**CV**	**Result**	**Variables**		**T Stat**	**Sign**	**CV**	**Result**
LNPF	AIC(2)	-1.1918	<	-3.4487	Non-stationary	DNPF	AIC(1)	-10.6750	>	-3.4491	Stationary
	SBC(2)	-1.1918	<	-3.4487	Non-stationary		SBC(1)	-10.6750	>	-3.4491	Stationary
LNPL	AIC(5)	-2.6404	<	-3.4487	Non-stationary	DNPL	AIC(2)	-5.4854	>	-3.4491	Stationary
	SBC(3)	-2.3057	<	-3.4487	Non-stationary		SBC(2)	-5.4854	>	-3.4491	Stationary
LCRE	AIC(4)	-0.7407	<	-3.4487	Non-stationary	DCRE	AIC(3)	-5.8209	>	-3.4491	Stationary
	SBC(4)	-0.7407	<	-3.4487	Non-stationary		SBC(3)	-5.8209	>	-3.4491	Stationary
LIR	AIC(1)	-1.8875	<	-3.4487	Non-stationary	DIR	AIC(1)	-6.5527	>	-3.4491	Stationary
	SBC(1)	-1.8875	<	-3.4487	Non-stationary		SBC(1)	-6.5527	>	-3.4491	Stationary
LER	AIC(1)	-1.0892	<	-3.4487	Non-stationary	DER	AIC(3)	-6.0305	>	-3.4491	Stationary
	SBC(1)	-1.0892	<	-3.4487	Non-stationary		SBC(1)	-7.9084	>	-3.4491	Stationary

Table 3: PP test for Unit root

H0: = 0 (Yt is a unit root/non-stationary)
H1: ≠ 0 (Yt is stationary)

	Level				1st Difference				
Variables	**T Stat**	**Sign**	**CV**	**Result**	**Variables**	**T Stat**	**Sign**	**CV**	**Result**
LNPF	-1.9568	<	-3.4619	Non-stationary	DNPF	-13.0679	>	-3.4475	Stationary
LNPL	-2.3079	<	-3.4619	Non-stationary	DNPL	-11.5702	>	-3.4475	Stationary
LCRE	-0.9274	<	-3.4619	Non-stationary	DCRE	-9.7601	>	-3.4475	Stationary
LIR	-1.2224	<	-3.4619	Non-stationary	DIR	-9.9691	>	-3.4475	Stationary
LER	-0.8154	<	-3.4619	Non-stationary	DER	-11.1988	>	-3.4475	Stationary

All the variables are transformed into logarithms to achieve stationary in variance. The unit root test on the basis of Augmented Dicker Fuller (ADF) and Philips-Perron (PP) clearly shows that all the variables are at I(1). The I(1) results indicates that the long term information at level is maintained suited well for long-run cointegraton, while running for short run relationship is still possible due the stationary nature at 1st difference. Hence, we proceeded to perform the cointegration test using the 8-steps procedure as summarized by Masih 2017.

We have decided to proceed on the basis of the results produced by ADF and PP despite the mixed results produced by KPSS. Using PP is succinct as we should expect the variables to be free from both autocorrelation and hateroscedasticity problems as PP corrects them using Newey-West adjusted-variance method.

Table 4: KPSS test for Unit root

H0: = 0 (Yt is stationary)
H1: ≠ 0 (Yt is a unit root/non-stationary)

	Level					1st Difference			
Variables	**T Stat**	**Sign**	**CV**	**Result**	**Variables**	**T Stat**	**Sign**	**CV**	**Result**
LNPF	0.1119	<	0.1378	Stationary	DNPF	0.0750	<	0.1378	Stationary
LNPL	0.0994	<	0.1378	Stationary	DNPL	0.0721	<	0.1378	Stationary
LCRE	0.1065	<	0.1378	Stationary	DCRE	0.1252	<	0.1378	Stationary
LIR	0.1562	>	0.1378	Non-stationary	DIR	0.0744	<	0.1378	Stationary
LER	0.1614	>	0.1378	Non-stationary	DER	0.0958	<	0.1378	Stationary

STEP 2: VAR (LAG) ORDER

To ascertain the order of the integration of the variables in the present case, we are using 6 as the maximum order of VAR. The results show that both Akaike information (AIC) and the Schwarz Bayesian (SBC) criteria select the order of 0. Nevertheless, the adjusted log-likelihood ratios indicate the p-value reject both order 0, at the 5% level, but do not reject the VAR at order of 2. On this basis, we choose the VAR(2) model as the 'optimal' order of VAR. The decision is justified given the short time frame and the small number of observations, coupled with the fact that lower lag helps us not to lose too much degree of freedom.

Table 5: Test Statistics and Choice Criteria for Selecting the Order of the VAR Model

Order	LL	AIC	SBC	LR test	Adjusted LR test
6	1557.7	1402.7	1189.9	------	------
5	1537.8	1407.8	1229.4	CHSQ(25)= 39.7630[.031]	29.0443[.262]

4	1519.5	1414.5	1270.4	CHSQ(50)= 76.3751[.010]	55.7871[.266]
3	1494.7	1414.7	1304.9	CHSQ(75)= 125.9274[.000]	91.9818[.089]
2	1474.9	1419.9	1344.5	CHSQ(100)= 165.4732[.000]	120.8674[.076]
1	1452.6	1422.6	1381.5	CHSQ(125)= 210.0828[.000]	153.4518[.043]
0	1437.6	1432.6	1425.8	CHSQ(150)= 240.1190[.000]	175.3913[.077]

Note: Based on 115 observations from 2007M8 to 2017M2. Order of VAR = 6
AIC=Akaike Information Criterion SBC=Schwarz Bayesian Criterion

STEP 3: TEST OF COINTEGRATION

Using univariate procedure, we proceed to test the hypothesis that Non-performing Financings (NPF), Non-performing Loans (NPL), domestic credit (CRE), lending rate (IR) and exchange rate (ER), all measured in logarithms, are integrated. The existence of cointegration implies that the logarithm of the share of the variables has been mean-reverting to a constant value over time. The relevant hypothesis is the variable is not a cointegrating relation or contains a unit root. Cointegration implies that these variables are interdependent and highly integrated. It also suggest that each variables contains information good for predictions of other variables in the long run.

ENGLE-GRANGER Method

Hypothesis:
H0: = 0 (Null is non-cointegration/ contains unit root)
H1: ≠ 0 (Null is cointegration)

In Engle and Granger method, using the cointegrating VAR option to test the abovementioned hypothesis, both AIC and SBC criteria indicate the selection of ADF regression of order 1. The null is then rejected at ADF(1) and therefore suggesting that *at least there is one or more cointegrations* relation among the five variables. At this point, it is therefore safe to proceed to the next stage owing to the existence of a cointegration.

Table 6: Unit root tests for residuals

	Test Statistic	95% Critical	AIC	SBC	HQC
DF	-4.9533	-4.5377	193.6914	192.3146	193.1325
ADF(1)	-5.0647	-4.5377	193.5677	190.8141	192.4499
ADF(2)	-4.1091	-4.5377	193.2184	189.0880	191.5417
ADF(3)	-4.5369	-4.5377	193.9478	188.4406	191.7122
ADF(4)	-3.9731	-4.5377	193.0734	186.1894	190.2789
ADF(5)	-3.9687	-4.5377	192.3517	184.0909	188.9983

Note: 122 observations used for estimation from 2007M1 to 2017M2

AIC = Akaike Information Criterion, SBC = Schwarz Bayesian Criterion, HQC = Hannan-Quinn Criterion

JOHANSEN APPROACH

Hypothesis:
H0: = 0 (Null is non-cointegration/ contains unit root)
H1: ≠ 0 (Null is cointegration)

The results using Johansen approach is rather conflicting. The maximum eigenvalue statistic fail to reject the null and hence suggesting that there is no cointegration (r=0). Nevertheless, the trace statistics reject the null hypothesis that there is no cointegration (r=0), but fail to reject the hypothesis that there is 2 cointegration relation between the variables (r=2) at 95% level. Hence, trace statistics seems to suggest 2 statistically significant cointegration relation between the five variables.

Table 7: Johansen's Cointegration Rank Test Statistics for Multiple Cointegrating Vector- Non-performing Financing, Non-performing Loan, Credit, Interest Rate and Exchange Rate

		Maximum Eigen Value Statistics		Trace Statistics	
H_0	H_1	Statistic	95% Critical	Statistic	95% Critical
r=0	r = 1	*34.0540*	*37.8600*	98.2843	87.1700
r<=1	r = 2	24.2836	31.7900	64.2302	63.0000
r<=2	r = 3	18.3416	25.4200	*39.9467*	*42.3400*
r<=3	r = 4	12.9046	19.2200	21.6050	25.7700
r<=4	r = 5	8.7004	12.3900	8.7004	12.3900

Note: 120 observations from 2007M3 to 2017M2. Order of VAR = 2.

Nevertheless, given that the earlier results of the residual-based method of Engel and Granger which discover at least there is one or more cointegrations relation among the five variables and based on theoretical reasoning, we have decided to settle at r=1. The results implies that the relationship among the variables is not spurious where the long terms theoretical relationship among the variables exists and achieve equilibrium in the long run.

STEP 4: LONG RUN STRUCTURAL MODELING (LRSM)

Since the intention is to identify the direction of causal relationship between non-performing financing (NPF) and non-performing loans (NPL), NPF being the focal variable has been selected as the dependent variable. Here, we apply LRSM to be sure that the coefficient of the cointegrating vector is consistent with the theoretical and a priori information of the economy (M. Masih et al., 2010). We proceeded to impose a normalizing restriction of unity and exact identification on the coefficient of NPF. The results show that only one coefficient of the cointegrating vector, NPL is significant while the rest of

the namely CRE, IR and ER are insignificant. This indicates that CRE, LIR and ER have no significant impact on NPF at this instance.

Over Identification Restrictions
Hypothesis:
H0: = Restrictions is correct.
H1: ≠ Restrictions is NOT correct.

Table 8: Exact and Over Identification on the Cointegrating Vector

Variables	**Panel A** **A1=1**	**Panel B** **A1=1; A3=0**	**Panel C** **A1=1; A4=0**	**Panel D** **A1=1; A5=0**
LNPF	1.0000 (*NONE*)	1.0000 (*NONE*)	1.0000 (*NONE*)	1.0000 (*NONE*)
LNPL	0.94392* (0.24136)	-1.2172 (0.15697)	-.81357 (0.16529)	-0.82794 (0.24426)
LCRE	2.1422 (1.7451)	.0000 (*NONE*)	3.0834 (1.2449)	3.4482 (1.4507)
LIR	0.37604 (0.46957)	0.78187 (0.41389)	0000 (*NONE*)	-0.050302 (0.34946)
LER	-.30947 (0.24737)	-0.50502 (0.22244)	-0.15053 (0.16297)	0000 (*NONE*)
Log Likelihood	1530.4	1529.9	1530.0	1529.7
Chi-Square	*None*	*1.0080[0.315]*	*0.63945[0.424]*	*1.3294[0.249]*
Conclusion	-	Do not reject Null: Restriction is correct.	Do not reject Null: Restriction is correct.	Do not reject Null: Restriction is correct.

However to confirm this situation, re-estimation of the cointegrating relation imposing the 'over-identification' restrictions individually (Panel B: A3=0, Panel C: A4=0, Panel D: A5=0) was performed on the coefficient of CRE, IR and ER. The 'Over-identification' results as depicted in table 8 clearly stated that null restriction of zero on CRE, IR and ER stands in all the panels as evidenced by the higher than 5% p-value. Hence, all the restrictions are correct. At this point, we have the option to drop the three variables due to the insignificant p-value implying the non influence of the three variables toward the dependent variable. However, owing to the evidence of a significant cointegrating relationship as well as strong theoretical reasons, we proceed with Panel A for the remaining of the analysis.

STEP 5: VECTOR ERROR CORRECTION MODEL (VECM)

The results in step 4-Cointegration test indicate the existence of at least one cointegration among the five variables however did not give information on the Granger causality i.e which is leading (exogenous) and which variable is lagging (endogenous). In order to ascertain the endogeneity/

exogeneity of the variables we employ the VECM for this purpose. The results will help us to give preliminary answer to one of our earlier question:- Are non-performing Financing (NPF- Islamic bank assets quality) and non-performing loans (NPL- conventional bank assets quality) related? Which leads or lags which?

Table 9: Vector Error Correction Model (VECM)

	dLNPF	dLNPL	dLCRE	dLIR	dLER
dLNPF1	-0.18004 (0.10685)	-0.27561 (0.069242)	0.008721 0.010233	-0.05442 0.028781	-0.00328 0.050353
dLNPL1	0.26458 (0.15091)	0.15619 (0.097796)	-0.02163 0.014453	0.084212 0.040649	0.016082 0.071117
dLCRE1	-1.5582 (1.0196)	-1.1367 (0.66072)	0.087524 0.097647	0.11097 0.27463	0.077701 0.48047
dLIR1	-0.60272 (0.3492)	-0.31845 (0.22629)	0.060996 0.033443	0.081691 0.094059	-0.07603 0.16456
dLER1	-0.07773 (0.21799)	-0.03526 (0.14126)	0.007005 0.020877	-0.03033 0.058716	0.014486 0.10272
ecm1(-1)	-0.07639 (0.053722)	0.11985 (0.034813)*	-0.013560 (0.005145)*	0.016263 0.01447	0.028013 0.025316
Implication	**EXO**	**ENDO**	**ENDO**	**EXO**	**EXO**
Serial Correlation	18.5239[.101]	22.2933[.034]	36.5539[.000]	11.6413[.475]	12.5290[.404]
Functional Form	0.51300[.474]	4.8471[.028]	1.6618[.197]	4.5222[.033]	.023170[.879]
Normality	33.2095[.000]	994.4439[.000]	6.9898[.030]	29.7134[.000]	16.3214[.000]
Heteroscedasticity	1.7324[.188]	2.1047[.147]	8.4536[.004]	2.9143[.088]	.25363[.615]

*Note: Standard errors are in parenthesis. *Indicates significance at the 5% level or less.*

The focus here is on the error-correction term that indicates the long term relations among the variables. The above results tend to indicate that in the long term, variable NPF, IR and ER are exogenous while NPL and CRE are endogenous. Interestingly, the results of our focal variables, NPF and NPL seem inconsistent with expectation. The coefficient of error-correction term for NPF is negative and insignificant while the error-correction term for NPL is positive and statistically significant at 5% level. This situation suggests that NPF is exogenous and hence does not depend on the changes of NPL. Therefore, being an endogenous status, NPL tend to respond to the changes in NPF. As a conclusion, NPF is the driver/ leader/ leads while NPL is the follower/ lags in our present study.

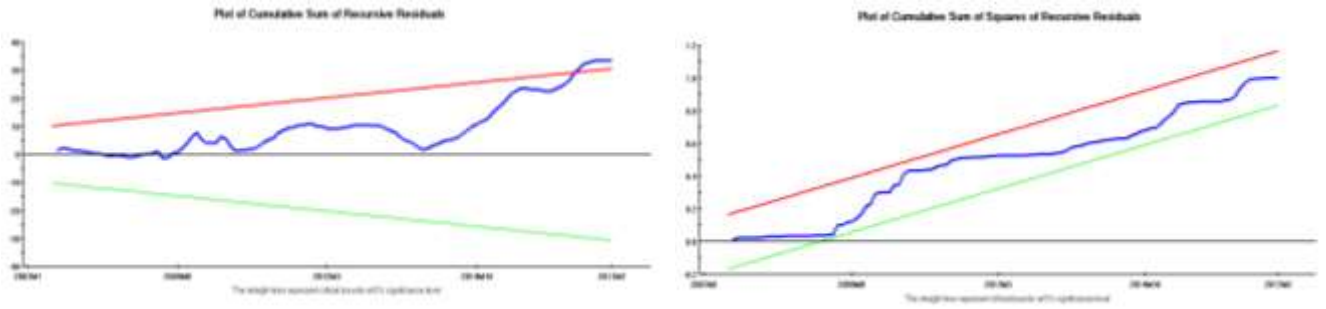


Figure 3: CUSUM and CUSUM SQUARE

We also check the stability of the coefficient by the CUSUM and CUSUM SQUARE tests (Figure 3), which indicates that they are stable.

The surprising results give rise to new explanations. Our earlier expectation where NPL should lead NPL doesn't come true. We expect NPL to lead NPF due to the following reasons: (1) this can be explained by the fact that in the banking system, NPF in terms of Ringgit Malaysia is small at RM5.5 billion as compared to RM25.5 billion of NPL as at February 2017 (see graph 1 & 2). Hence, NPL is therefore dominant in this aspect. Any changes in NPF should be responded by NPF accordingly. (2) Islamic and conventional banks operations is almost identical. The business model of Islamic banks is apparently a direct replication of conventional banks with Shariah compliant contract (Anuar & Mohamad, 2014). Both offers similar banking products and the direct replication makes Islamic banks the follower of the conventional bank in many aspects. In the event of crisis, both banks tend to behaves similarly and should face the same consequences given the similarity in the banking products.

The not as expected results (NPF is an exogenous variable) are due to these possible reasons: (1) the fact that both Islamic banks and conventional banks impaired assets is exogenous and endogenous respectively suggest that they are "different" in some ways. Perhaps the difference lies in the fact that both operate under different principles. Islamic banks operates under the profit and loss sharing (PLS) that rely on equity funds that generate return-on-equity while conventional financing sourced their funds from debt and interest based deposits that later generates interest-on-loan as their bottom line. (2) Apart from the above, the Islamic bank provides banking alternatives may it be to the Shariah concerned investors as well as the conventional investors looking for diversification purposes (Hasan & Dridi, 2010). This is one of the factors that give rise to the strong demand and growth for Islamic financing product thus making Islamic banking product dominant as compared to its conventional counterpart. (3) We also believe that Islamic banks in Malaysia may be subject to interference from the government. Being one of

the most potential industries, the Islamic banking industry is well monitored by the government to ensure positive progress towards being the most preferred Islamic financial hub in the region.

STEP 6: VARIANCE DECOMPOSITION

This section describes the VDC. Although VECM helps to indicate the endogeneity/ exogeneity of a variable, it cannot tell us the lead-lag relationship between the variables. This is important as we have yet to confirm the dependent and independent variable. Since the beginning, we have not specify those variables (except in VECM where we found the endogeneity/ exogeneity of the variables) as in time series technique the data will determine whether which variable is dependent and independent. VDC gives relative causality i.e relative exogeneity/ endogeneity and the direction of causality from most exogenous to least exogenous by ranking the variables in % according to how much the variables depends on its own past lag. The more it depends on its own past, the more exogenous it is.

Table 10: Ranking based on VDC (Generalized)

	HORIZON	LNPF	LNPL	LCRE	LIR	LER	TOTAL	SELF-DEP	RANKING
LNPF	6	78.83%	14.87%	1.49%	4.24%	0.56%	100.00%	78.83%	4
LNPL	6	27.26%	68.71%	2.52%	1.24%	0.28%	100.00%	68.71%	5
LCRE	6	3.89%	0.17%	83.45%	0.99%	11.50%	100.00%	83.45%	2
LIR	6	0.90%	0.47%	0.59%	94.35%	3.69%	100.00%	94.35%	1
LER	6	4.56%	0.04%	12.92%	3.62%	78.85%	100.00%	78.85%	3

	HORIZON	LNPF	LNPL	LCRE	LIR	LER	TOTAL	SELF-DEP	RANKING
LNPF	12	81%	13%	2%	5%	1%	100%	81%	2
LNPL	12	50%	45%	2%	3%	0%	100%	45%	5
LCRE	12	9%	0%	79%	2%	10%	100%	79%	3
LIR	12	1%	0%	1%	95%	3%	100%	95%	1
LER	12	6%	0%	12%	4%	77%	100%	77%	4

	HORIZON	LNPF	LNPL	LCRE	LIR	LER	TOTAL	SELF-DEP	RANKING
LNPF	30	83%	9%	1%	5%	1%	100%	83%	2
LNPL	30	73%	20%	2%	5%	0%	100%	20%	5
LCRE	30	19%	1%	70%	3%	7%	100%	70%	4
LIR	30	4%	0%	1%	93%	3%	100%	93%	1
LER	30	9%	0%	12%	5%	74%	100%	74%	3

	HORIZON	LNPF	LNPL	LCRE	LIR	LER	TOTAL	SELF-DEP	RANKING
LNPF	60	84%	8%	1%	6%	1%	100%	84%	2
LNPL	60	79%	14%	2%	5%	0%	100%	14%	5
LCRE	60	24%	1%	66%	3%	6%	100%	66%	4
LIR	60	5%	0%	1%	91%	3%	100%	91%	1
LER	60	10%	0%	11%	5%	73%	100%	73%	3

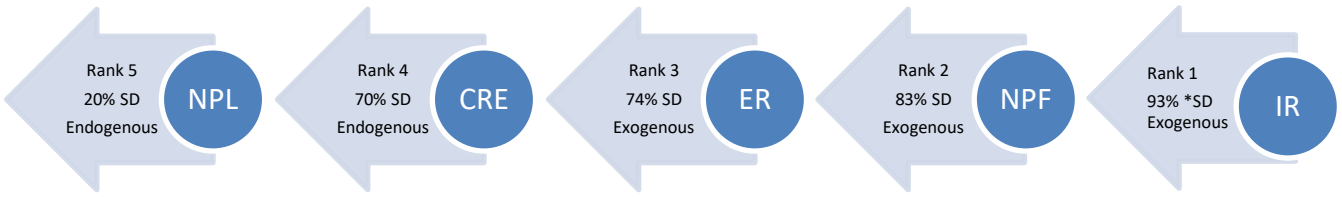


Figure 4: Direction of Causality from left to right (*SD denotes Self Dependent).
NPL=Non-performing loans, CRE=Domestic credit, ER=Exchange rate, NPF=Non-performing Financing and IR=Interest rate.

The results for over a 60-month horizon are summarized in Tables 10. Overall, figure 4 suggest that in interest rate variable, 93% of the forecast error variance of interest is explained by its own shock, followed by non-performing financing at 83%, exchange rate at 74%, credit at 70% and finally non-performing loans at 20%. At this instance, the results suggest that interest rate is the most exogenous variable while non-performing loan is the least endogenous. It should be noted that interest rate- IR variable is the most exogenous among all the five variables indicating that IR rely on its own self and the rest depends on IR in this respect. The VDC results further strengthen the VECM results in the previous step suggesting that NPF leads NPF and not vice versa.

As for our focus variables, the 12 month forecast period indicates that NPF and NPL are exogenous and endogenous variable respectively, in line with the results in VECM. The exogenous/ endogenous status maintains for the forecast horizon number 30 and 60 months, thus conforming their existing status. The direction of the causality in figure 4 clearly shows that NPF is leading the NPL variable. Hence, NPF (exogenous) tend to lead rather than lag the NPL variable (endogenous). The result is surprising as it is not as per our expectations. The possible reasoning is discussed in step 5 earlier.

Figure 3 shows the direction of the causality from left to right for all the variables under study. Several important informations can be derived from these directions: (1) NPL being the most endogenous

will respond to the changes in credit, exchange rate, non-performing financing and interest rates. The regulator can influence the amount of credit granted by the banks using restrictive policy on credit with the help of the banks through moral suasion, good credit practices and selected credit control for instance. This can help banks to keep good asset quality thus avoiding a disastrous bad debt in times of crisis. Exchange rate is another variable that can be hit by the regulator in order to influence the level of NPL. A stable exchange rate can be achieved through Bank Negara market intervention in the forex market. The existing Bank Negara reserve of USD95 billion can be sufficiently used to back up Malaysian Ringgit if needed or alternatively imposing capital control or going for fixed rate regime. Being an importing country, when the USD rate goes up, domestic currency depreciates and NPLs increases owing to the higher cost of imports and increase financing cost for companies that borrow in foreign currency which in turn decreases companies' profit margin and reducing repayment capability (Claudio Borio & Lowe, 2002). Hence, the increase in the currency leads to the rise in NPL. In such situation, stabilizing the exchange rate is required. The next exogenous variable, non-performing financing- NPF is a possible factor that can be influenced according to the results. However, we are of the opinion that the variable turned exogenous most probably because of the interference from the government in its good intention to preserve and foster growth in Islamic banking industry. For this reason, we would suggest the policy maker to focus on the next exogenous variable, interest rate.

(2) Based on the causality direction, interest rate being the most exogenous is the only variable that can be influenced by the policy maker to affect both NPF and NPL. When interest rate is high, cost of borrowing is increased and subsequently loosened debt repayment capability while the economy weakens accordingly (Louzis et al., 2012). Finally, NPF will rise in such cases. The above suits the theoretical model of business cycle and life-cycle consumption model which states that the borrowers with low income have higher rates of default due to increased risk of facing unemployment and being unable to settle their obligations. Banks then charge higher interest rates to riskier customer. Default is then sparks by uncertainty of future income and the lending rates (Ghosh, 2015). In this connection, the amount of credit extended to banks clients will deteriorate. For Islamic banks, although Islamic principles forbid the use of interest, profit rates of Islamic banks are effected by the movements of interest rate and not vice versa (Anuar & Mohamad, 2014). Hence, interest rate is one factor that can influence NPF. In a much recent development, the consistent reduction of interest rate in the past few years also reflects the reduction of NPF and NPL in the Malaysian environment. Bank Negara Malaysia being the regulator plays an important role in influencing the stable movement of interest rate in the country. This can be

achieved through the influence on the rate via monetary policy that subsequently affects the overnight policy rate- OPR, base lending rate- (BLR) etc.

STEP 7: IMPULSE RESPONSE FUNCTION (IRF)

This study also uses impulse response to find the impact of one variable on others, their degree of response and how long it will take to normalize. In this study we a particularly interested to look at the reaction of other variables when the focus variable, NPF and NPL is shocked separately. The generalized IRF shows that generally the NPL variable is more senstitive to a 1% shock to the NPF as compared to the sensitivity of NPF variable when a 1% shock in the NPL (Figure 5 & 6). The results of IRFs depicted in graph is consistent with the VDC results earlier.

Figure 5: Generalize impulse response to one SE shock in the equation for LNPF

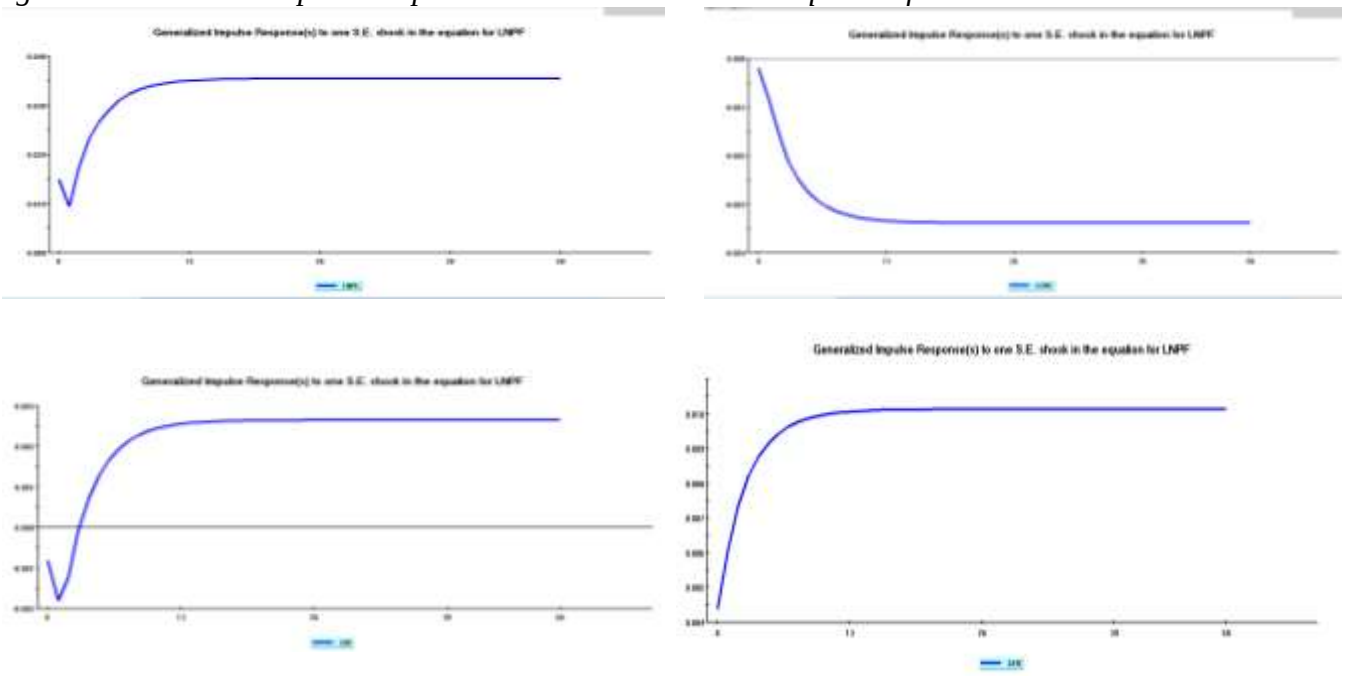
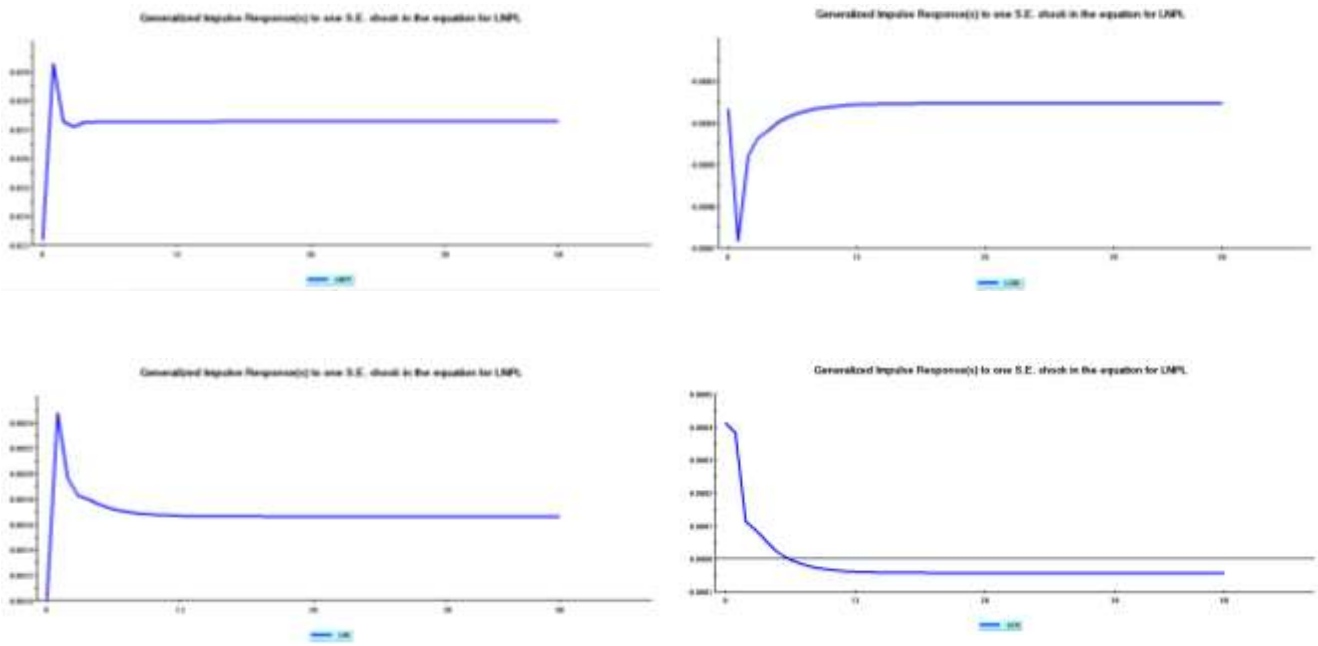
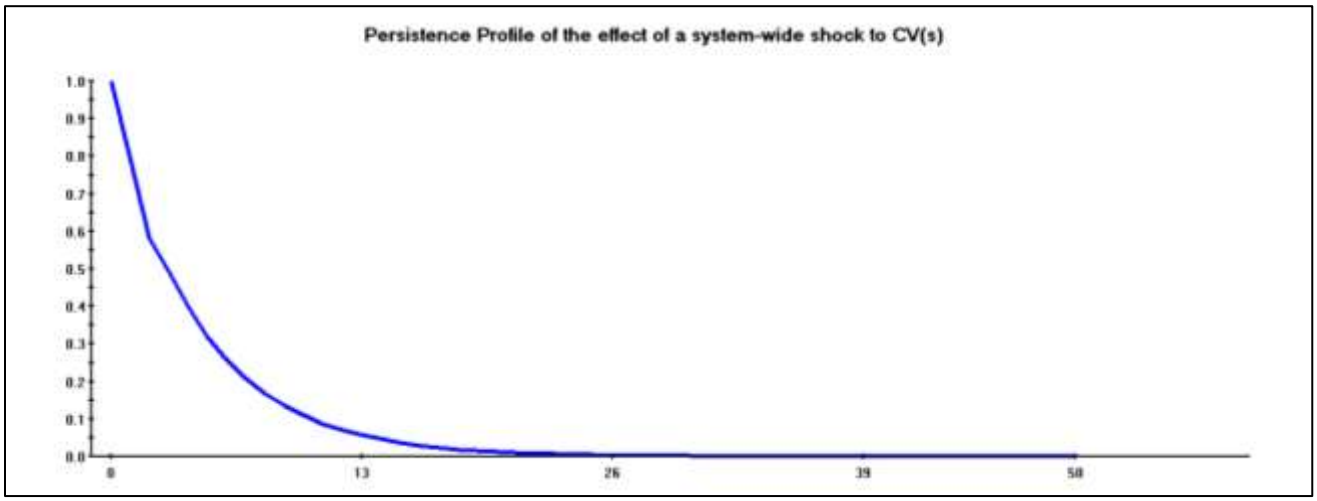


Figure 6: Generalize impulse response to one SE shock in the equation for LNPL



STEP 8: PERSISTANCE PROFILE (PP)



The above graph depicts the persistence profile from a system wide shock. PP is a system-wide shock on the long run relations where we shock the whole cointegrating relationship and see how long it will take the system to get back to equilibrium. In this study, PP indicates that it will take 26 months for the equilibrium to be restored.

7. Conclusion and Policy Implications

This paper assesses the causality issue between non-performing financing (NPF) and non-performing loans (NPL), together with macroeconomics variables in Malaysia using time series cointegrating VAR models. The Long Run Structural Modelling (LRSM), Vector Error Correction Model (VECM) and Variance Decomposition (VDC) were also employed to generate meaningful results suitable for the policy maker and practitioners. Apart from the focal variables, NPF and NPL we added three domestic macroeconomic variables specifically domestic credit, real lending rate and exchange rate to further understand the variables under study. All variables are I(1) in nature on the basis Augmented Dicker Fuller (ADF) and Philips-Perron (PP) unit root test.

In summary, the VECM and VDC analysis strongly support the results that NPF and NPL variables are exogenous and endogenous respectively. VDC further strengthen the exogeneity status of NPF based on the approximate 83% dependent on its own past lag, while only 20% for NPL variable. Being the endogenous variable, NPL tend to respond to the changes in NPF accordingly. The data simultaneously makes us to conclude, contrary to expectation, that NPF leads NPL in this respect. Various reasons were linked to this situation, for instance the unique shariah compliant principles adopted by Islamic banks that differentiate them from their conventional counterparts and the growing demand for Islamic banking products that provides banking alternatives may it be to the Shariah concerned investors as well as the conventional investors looking for diversification purposes. We are quite comfortable to state that Islamic banks in Malaysia may be subject to interference from the government.

On the policy maker side, NPL being the most endogenous will respond to the changes in credit, exchange rate, non-performing financing and interest rates. Hence, the regulator can influence the amount of credit granted by the banks using restrictive policy on credit with the help of the banks through moral suasion, good credit practices and selected credit control. Stabilization of the exchange rate is also required via forex market intervention, capital control or going for fixed currency regime. The NPF variable, although exogenous should be left alone since we suspect the variable turned exogenous most probably because of the interference from the government. Finally, interest rate being the most exogenous is the only variable that can be influenced by the policy maker to affect both NPF and NPL. This can be achieved through the influence on the rate via monetary policy that subsequently affects the overnight policy rate- OPR, base lending rate- (BLR) etc.

References

Abid, L., Ouertani, M. N., & Zouari-Ghorbel, S. (2014). Macroeconomic and Bank-specific Determinants of Household's Non-performing Loans in Tunisia: A Dynamic Panel Data. *Procedia Economics and Finance*, *13* December 2013, 58–68.

Anuar, K., & Mohamad, S. (2014). Are Deposit and Investment Accounts in Islamic Banks in Malaysia Interest Free ? *JKAU: Islamic Econ.*, *27*(2), 27–55.

Bank Negara Malaysia. (2015). *Classification and Impairment Provisions for Loans / Financing*.

Beck, R., Jakubik, P., & Piloiu, A. (2015). Key Determinants of Non-performing Loans: New Evidence from a Global Sample. *Open Economies Review*, *26*(3), 525–550.

Borio, C., & Lowe, P. (2002). Asset prices, financial and monetary stability: exploring the nexus. *BIS Working Paper*, (114), 47.

Borio, C., & Lowe, P. (2002). Asset prices , financial and monetary stability : exploring the nexus. *BIS Working Papers*, (114).

Chaibi, H., & Ftiti, Z. (2015). Research in International Business and Finance Credit risk determinants : Evidence from a cross-country study. *Research in International Business and Finance*, *33*, 1–16.

Dimitrios, A., Helen, L., & Mike, T. (2016). Determinants of non-performing loans : Evidence from Euro-area countries. *Finance Research Letters*, *18*, 116–119.

Florin, B. (2015). The quality of bank loans within the framework of globalization. *Procedia Economics and Finance*, *20*(15), 208–217.

Fofack, H. L. (2005). Nonperforming loans in Sub-Saharan Africa : Causal analysis and macroeconomic implications. *Working Paper of World Bank Policy Research*, (WPS3769), 1–36.

Ghosh, A. (2015). Banking-industry specific and regional economic determinants of non-performing loans: Evidence from US states. *Journal of Financial Stability*, *20*, 93–104.

Gujarati, D. N. (2004). *Basic Econometrics*. *New York*. The McGraw- Hill Companies.

Hasan, M., & Dridi, J. (2010). The Effects of the Global Crisis on Islamic and Conventional Banks : A Comparative Study. *IMF Working Paper*, *WP/10/201*.

Kavkler, A., Repina, S., & Festic, M. (2011). The macroeconomic sources of systemic risk in the banking sectors of five new EU member states, *35*, 310–322.

Klein, N. (2013). Non-Performing Loans in CESEE: Determinants and Impact on Macroeconomic Performance. *IMF Working Papers*, *13*(72), 1.

Louzis, D. P., Vouldis, A. T., & Metaxas, V. L. (2012). Macroeconomic and bank-specific determinants of non-performing loans in Greece: A comparative study of mortgage, business and consumer loan portfolios. *Journal of Banking and Finance*, *36*(4), 1012–1027.

Masih, M., Al-Sahlawi, M. A., & Mello, L. De. (2010). What drives carbon-dioxide emissions: income or electricity generation? evidence from saudi arabia, *Journal of Energy and Development*, *33*(2), 201-213.

Pesaran, H., & Shin, Y. (2002). Long-Run Structural Modelling, *Econometric Reviews*, 21(1), 49-87.